[translation]

Korean Intellectual Property Office

NOTICE OF NON-FINAL OFFICE ACTION

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Application No.: 10-2006-7003836

Title: Method and Device for Recognizing a Dual Point User Input on a Touch Based User Input Device

The applicant is hereby notified pursuant to Article 63 of the Korean Patent Law that this application is rejected on the following grounds. Any arguments with or without Amendment that the applicant may wish to submit in response to this rejection must be filed by **29 August 2007**. An unlimited number of one-month extensions of the term for filing a response are available and may be filed with an appropriate fee by each respective due date. However, the Korean Intellectual Property Office (KIPO) does not issue a response to the filing of a request for an extension.

[EXAMINATION RESULTS]

- Rejected Claims: Claims 1-22
- Examination Result Excluding Claims: none
- Allowable Claims: none

[GROUNDS OF REJECTION]

1. The invention as recited in Claims 1 - 4 and 12 - 22 of the present application would have been obvious to those having ordinary skill in the art prior to the filing of the application, and thus this application cannot be patented according to Article 29, Paragraph 2 of the Korean Patent Law, as follows:

1) Claim 1 is directed to a method of recognizing a dual point user input on a touch based user input device, the method including determining on the basis of a first

position signal and a second position signal if the second user input has its source in a simultaneous dual point user input, and generating a third position based on the first position signal and the second position signal and using the first and third positions as the coordinates of the dual pint user input.

The invention disclosed in the cited reference (European Patent Application No. EP 0745953 A2, published on December 4, 1996) relates a coordinate detecting device and method and a computer control device using the method. The coordinate detecting apparatus is formed using a resistive film, and a part of the resistive film is set as a selection area in order to select an input state. The discrimination means senses a one-point input applied by applying pressure onto the outside of the selection area, and dual simultaneous inputs at two points, one of which is applied to the selection area and the other of which is applied to the resistive film. The retaining means stores the coordinates of the first input point. The memory means stores a formula of calculating the coordinates of the second input point from the stored coordinates of the first input point and the output voltage of the second input point in the resistive film. The controlling means determines the coordinates of the second input point by using the formula if the discrimination means senses the dual simultaneous inputs.

The operation of "determining on the basis of said first position signal and said second position signal, if said second user input has its source in a simultaneous dual point user input" (Claim 1), corresponds to the discrimination means sensing the dual simultaneous inputs based on the selection area (Cited reference). The operation of "generating a third position based on said first position signal and said second position signal" (Claim 1), corresponds to the controlling means determining the coordinates of the second input point from the coordinates of the first input point and the output voltage of the second input point in the resistive film (Cited reference). Although Claim 1 describes the operation of using the first and third positions as the coordinates of said dual pint user input, this operation could have been derived from the coordinates of the second input point that are determined by the controlling means and the computer controlling device having the controlling means, as set forth in the cited reference. Accordingly, it is deemed that Claim 1 would have been obvious to those of ordinary skill in the art from the cited reference.

2) Claims 2 - 4 referring to the method of Claim 1 define that the third position is essentially the same location as the second user input, the operation of determining is based on the gradient between the first position signal and the second position signal, and an operation of storing the first and third positions is further comprised.

However, the feature, that the third position is essentially the same location as the second user input, of Claim 2 of the present application corresponds to that of cited reference that the coordinates of the second input point are the same as those of the second input point of the dual simultaneous inputs. The feature, that the operation of determining is based on the gradient between the first position signal and the second position signal, of Claim 3 of the present application corresponds to that of cited reference that the formula of calculating the coordinates of the second input pint uses a variation in the voltage of the second input point in the resistive film. The feature of

Claim 4 of the present application that the operation of storing the first and third positions corresponds to that of cited reference that the retaining means stores the first and second input points of the dual simultaneous inputs. Accordingly, it is deemed that Claims 2 - 4 would have been obvious to those of ordinary skill in the art from the cited reference..

3) Claims 12 - 15 are directed to the method defining that the second position is set as the new position of an actual single point user input if the second position input does not have its source in a dual point user input, wherein the input device is capable of only outputting a single input position signal that depends on the actual user input, the first position signal is stored, and the second position is different from the first position.

However, the feature, that the setting of the second position as the new position of an actual single point user input if the second position input does not have its source in a dual point user input, of Claim 12 of the present application corresponds to that of cited reference that if pressure applied to the outside of the selection area is sensed, the discrimination means senses it as a one-point input. The feature of Claim 13 of the present application that the input device capable of only outputting a single input position signal that depends on the actual user input corresponds to that of cited reference that the computer controlling device using the coordinates of a sensed single input. The feature of Claim 14 of the present application that the storing of the first position signal corresponds to that of cited reference that the storing of the coordinates of the single input in the retaining means. The feature of Claim 15 of the present application that the second position is different from the first position corresponds to that of cited reference that the coordinates of a single input is different from those of a recent single input that was previously stored in the retaining means. Accordingly, it is deemed that Claims 12 through 15 would have been obvious to those of ordinary skill in the art from the cited reference.

* Please note that the invention as forth in Claims 12 -15 that refers to Claims 5 - 11 and defines the invention in Claims 5 - 11 has an inventive step.

4) Claims 16 - 18 are directed to a software tool or a computer program product for carrying out the method of any one of claims 1 - 15 would have been obvious to those of ordinary skill in the art from the cited reference, as described in the above reasons for rejection (1) through (3).

* Please note that the invention as set forth in Claims 19 and 20 that refers to Claims 5 through 11 and define the invention disclosed in Claims 5 through 11 has an inventive step.

5) Claims 19 and 20 are directed to a touch based input device including an input, a memory, a differentiator, a first evaluation circuit, a second evaluation circuit, and an output. The input, the memory, and the differentiator respectively correspond to the resistive film, the retaining means, and the calculation means that calculates the characteristics of a change in the locations of the first and second input points. The first and second evaluation circuits correspond to the discrimination means disclosed in the cited reference. Although Claim 19 further includes the output, the output can be

derived from the coordinates of the second input point that are determined by the controlling means and from the computer controlling device having the controlling means. Accordingly, it is deemed that Claim 19 would have been obvious to those of ordinary skill in the art from the cited reference.

6) Claims 21 and 22 are directed to an electronic device including a touch based input device, a processor, and a controller. The touch based input device and the controller respectively correspond to a touch panel and the controlling means disclosed in the cited reference. Although Claims 21 and 22 further include the processor, the processor can be derived from the compute controlling device disclosed in the cited reference. Accordingly, it is deemed that Claims 21 and 22 would have been obvious to those of ordinary skill in the art from the cited reference.

2. Claims 1 through 18, 22 and 22 of the present application are not in condition for allowance under Article 42, Paragraph 4 (2) of the Korean Patent Law, for the following informalities:

1) In the expression, "forming a second position signal relating to said first input and said second input" recited in Claim 1, the second input is described as if it had been recited in the preceding claim(s) but is actually first described. In the expression, "determining on the basis of said first position signal and said second position signal" recited in Claim 1, it is unclear as to which object is determined. Accordingly, it is deemed that Claim 1 is not clearly recited.

2) Claims 2 - 18 refer to Claim 1 that is unclearly recited, and thus, it is deemed that they are not clearly recited.

3) In the expression, "third position is essentially the same location as the said second user input at said second position" recited in Claim 2, the expression, "is essentially the same location as" does not clearly represent the relationship between the third location and the second user input. Thus, it is deemed that Claim 2 is not clearly recited.

4) Claims 3 - 18 refer to Claim 2 that is unclearly recited, and thus, it is deemed that they are not clearly recited.

5) In the expression, "calculating a motion of said position that is not said point of reference" recited in Claim 5, it is unclear as to what the "said position" refers to. Thus, it is deemed that Claim 5 is not clearly recited.

6) Claims 6 - 18 refer to Claim 2 that is not clearly recited, and thus it is deemed that they are not clearly recited.

7) In the expression, "boundary area defined by possible input options" recited in Claim 7, it is unclear as to the meaning of the "possible input options". Thus, it is deemed that Claim 7 is not clearly recited.

8) Claims 8 - 18 refer to Claim 8 that is not clearly recited, and thus it is deemed that they are not clearly recited.

9) The "said second position input" recited in Claim 9 is described as if it had been recited in the preceding claim(s) but is actually first described. Thus, it is deemed that Claim 9 is not clearly recited.

10) Claims 10 - 18 refer to Claim 9 that is not clearly recited, and thus it is deemed that they are not clearly recited.

11) The "actual user input" recited in Claim 13 is described as if it had been recited in the preceding claim(s) but is actually first described. Thus, it is deemed that Claim 13 is not clearly recited.

12) Claims 14 - 18 refer to Claim 13 that is not clearly recited, and thus it is deemed that they are not clearly recited.

13) Claim 16 is directed to a software tool but it is unclear as to whether the software tool corresponds to an object or a method. That is, the category of the invention recited in Claim 16 is unclear. Thus, it is deemed that Claim 16 is not clearly recited.

14) Claims 17 and 18 are directed to a computer program product but it is unclear as to whether the computer program product corresponds to an object or a method. That is, the category of the invention recited in Claims 17 and 18 are unclear. Thus, it is deemed that Claims 17 and 18 are not clearly recited.

15) Claim 20 defines an input but Claim 19 to which Claim 20 refers also describes an input, and thus, the relationship between "the input" recited in Claim 19 and "the input" recited in Claim 20 is not clear. Accordingly, it is deemed that Claim 20 is not clearly recited.

16) The "said device" recited in Claim 22 is described as if it had been recited in the precedent claim(s) but is actually first described. Therefore, since it is unclear as to what the "said device" refers to, it is deemed that Claim 22 is not clearly recited.

3. Claims 4, 5, 7, 9 and 11 - 18 of the present application are not in condition for allowance under Article 42, Paragraph 5 of the Korean Patent Law and Article 5, Paragraph 6 of the Enforcement Degree of the same law, as follows:

Claims 4, 5, 7, 9 and 11 - 18 are multiple dependent claims referring to other multiple dependent claims, and therefore do not clearly describe the invention.

[Enclosure] A copy of EP00745953

29 June 2007

KOREAN INTELLECTUAL PROPERTY OFFICE

Information and Communications Examinations Bureau
Computer Examination Team

Examiner(s): Jongik Lee

발송번호: 9-5-2007-036400893
발송일자: 2007.06.29
제출기일: 2007.08.29

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137-875

YOUR INVENTION PARTNER

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의견제출통지서

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출원번호 10-2006-7003836
발명의 명칭 터치 기반 사용자 입력 장치상의 듀얼 포인트 사용자입력을 인지하기 위한 방법 및 장치

이 출원에 대한 심사결과 아래와 같은 거절이유가 있어 특허법 제63조의 규정에 의하여 이를 통지하오니 의견이 있거나 보정이 필요할 경우에는 상기 제출기일까지 의견서[특허법시행규칙 별지 제25호의2서식] 또는/및 보정서[특허법시행규칙 별지 제5호서식]를 제출하여 주시기 바랍니다.(상기 제출기일에 대하여 매회 1월 단위로 연장을 신청할 수 있으며, 이 신청에 대하여 별도의 기간연장승인통지는 하지 않습니다.)

[심사결과]

☐ 거절이유가 있는 청구범위 : 제1항 내지 제22항
☐ 청구범위외 심사결과 : 해당사항 없음
☐ 등록가능한 청구범위 : 해당사항 없음

[이유]

1. 이 출원의 특허청구범위 제1항 내지 제4항, 제12항 내지 제22항에 기재된 발명은 그 출원전에 이 발명이 속하는 기술분야에서 통상의 지식을 가진 자가 아래에 지적한 것에 의하여 용이하게 발명할 수 있는 것이므로 특허법 제29조제2항의 규정에 의하여 특허를 받을 수 없습니다.

[아래]

가. 본원 청구범위 제1항은 방법에 관한 것으로, 제2 사용자 입력이 동시적인 듀얼 포인트 사용자 입력 내에 그 출처를 지니는 경우 제1 위치 시그널 및 제2 위치 시그널을 기초로 결정하는 단계, 상기 제1 위치 시그널 및 상기 제2 위치 시그널을 기초로 제3 위치를 생성하는 단계, 제1 위치 및 제3 위치를 상기 듀얼 포인트 사용자 입력의 좌표축으로 이용하는 단계를 포함하여 구성되는 것을 그 특징으로 합니다.

다. 본원 청구범위 제12항 내지 제15항은 방법에 관한 것으로, 제2 위치 입력이 듀얼 포인트 사용자 입력 내에 그 출처를 지니지 않는 경우 상기 제 2위치를 실제 싱글 포인트 사용자 입력의 새로운 위치로 설정하고, 입력 장치는 실제 사용자 입력에 의존하는 단일 입력 위치 시그널을 출력하며, 상기 제1 위치 시그널을 저장하고, 상기 제2 위치는 제1 위치와 다른 것을 그 부가적인 특징으로 합니다.

본원 청구범위 제12항 내지 제15항에서 제2 위치 입력이 듀얼 포인트 사용자 입력 내에 그 출처를 지니지 않는 경우 상기 제 2위치를 실제 싱글 포인트 사용자 입력의 새로운 위치로 설정하는 것은 인용발명에서 감지 수단이 상기 선택 영역의 외부에 인가된 압력을 감지한 경우, 단일 입력(one-point input)으로 감지하는 것, 본원 청구범위 제12항 내지 제15항에서 입력 장치는 실제 사용자 입력에 의존하는 단일 입력 위치 시그널을 출력하며, 상기 제1 위치 시그널을 저장하는 것은 각각 인용발명에서 감지된 단일 입력의 좌표값을 이용하는 컴퓨터 제어 장치, 상기 단일 입력의 좌표값을 저장 수단에 저장하는 것에 대응되며, 본원 청구범위 제12항 내지 제15항에서 제2 위치는 제1 위치와 다른 것은 인용발명에서 상기 단일 입력의 좌표값은 그 이전에 저장 수단에 저장된 최근 단일 입력의 좌표값과 다른 것에 대응됩니다.
따라서, 본원 청구범위 제12항 내지 제15항은 인용발명으로부터 이 발명이 속한 기술분야에서 통상의 지식을 가진 자가 용이하게 발명할 수 있습니다.
※ 본원 청구범위 제12항 내지 제15항에 기재된 발명중, 청구범위 제5항 내지 제11항을 인용하고 해당 발명을 한정 부가한 발명은 진보성이 있음을 알려드립니다.

라. 본원 청구범위 제16항 내지 제18항은 청구범위 제1항 내지 제15항중 어느 한 항의 방법을 수행하기 위한 소프트웨어 툴, 컴퓨터 프로그램 제품에 관한 것으로, 상기 가목 내지 다목에 기재된 바와 같이 인용발명으로부터 이 발명이 속한 기술분야에서 통상의 지식을 가진 자가 용이하게 발명할 수 있습니다.
※ 본원 청구범위 제16항 내지 제18항에 기재된 발명중, 청구범위 제5항 내지 제11항을 인용하고 해당 발명을 한정 부가한 발명은 진보성이 있음을 알려드립니다.

마. 본원 청구범위 제19항 내지 제20항은 장치에 관한 것으로, 입력부, 메모리, 미분기, 제1 검증회로, 제2 검증회로, 출력부로 구성되는 것을 그 특징으로 합니다.

본원 청구범위 제19항의 입력부, 메모리, 미분기는 각각 인용발명의 저항성 필름, 저장 수단, 첫 번째 및 두 번째 입력점에 대한 이동 위치의 특성을 산입하는 계산 수단에 대응되고, 본원 청구범위 제19항의 제1 검증회로, 제2 검증회로는 인용발명의 감지 수단에 대응됩니다.
다만, 본원 청구범위 제19항은 출력부를 구비하고 있으나, 이것은 인용발명의 제어 수단에서 결정된 두 번째 입력점의 좌표 값과 상기 제어 수단을 구비한 컴퓨터 제어 장치에 대한 기재로부터 그 발명이 시사된 것입니다.
따라서, 본원 청구범위 제19항은 인용발명으로부터 이 발명이 속한 기술분야에서 통상의 지식을 가진 자가 용이하게 발명할 수 있습니다.

위를 특정할 수 없습니다.

아. 본원 청구범위 제8항 내지 제18항은 그 기재가 불비한 청구범위 제8항을 인용하고 있어, 해당 청구범위를 특정할 수 없습니다.

자. 본원 청구범위 제9항은 "상기 제2 위치 입력"을 기재하여, 제2 위치 입력을 인용형식으로 기재하고 있으나, 제2 위치 입력은 그 이전에 해당 기재가 없는 것으로, 해당 청구범위를 특정할 수 없습니다.

차. 본원 청구범위 제10항 내지 제18항은 그 기재가 불비한 청구범위 제9항을 인용하고 있어, 해당 청구범위를 특정할 수 없습니다.

카. 본원 청구범위 제13항은 실제 사용자 입력을 인용형식으로 기재하고 있으나, 상기 실제 사용자 입력은 그 이전에 해당 기재가 없는 것으로, 해당 청구범위를 특정할 수 없습니다.

타. 본원 청구범위 제14항 내지 제18항은 그 기재가 불비한 청구범위 제13항을 인용하고 있어, 해당 청구범위를 특정할 수 없습니다.

파. 본원 청구범위 제16항은 소프트웨어 툴을 청구하고 있으나, 상기 소프트웨어 툴이 물인지 방법인지 그 카테고리가 명확하지 않아, 해당 청구범위를 특정할 수 없습니다.

하. 본원 청구범위 제17항 내지 제18항은 컴퓨터 프로그램 제품을 기재하고 있으나, 상기 컴퓨터 프로그램 제품이 물인지 방법인지 그 카테고리가 명확하지 않아, 해당 청구범위를 특정할 수 없습니다.

거. 본원 청구범위 제20항은 입력부를 부가하여 기재하고 있으나, 인용하고 있는 청구범위 제19항에도 입력부가 기재되어 있어, 상기 부가된 입력부와 청구범위 제19항의 입력부간의 결합구조가 명확하지 않아, 해당 청구범위를 특정할 수 없습니다.

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3. 이 출원은 특허청구범위 제4항 내지 제5항, 제7항, 제9항, 제11항 내지 제18항의 기재가 아래에 지적한 바와 같이 불비하여 특허법 제42조제5항 및 동법시행령 제5조제6항의 규정에 의한 요건을 충족하지 못하므로 특허를 받을 수 없습니다.

[아래]

본원 청구범위 제4항 내지 제5항, 제7항, 제9항, 제11항 내지 제18항은 2이상의 항을 인용하는 청구항이나, 2이상의 항을 인용한 항을 인용하고 있는 다른 청구항을 인용하고 있으며, 이것은 청구범위의 기재방법에 위배되는 것입니다.

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 745 953 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.12.1996 Bulletin 1996/49

(51) Int. Cl.[6]: G06K 11/12

(21) Application number: 96108591.7

(22) Date of filing: 30.05.1996

(84) Designated Contracting States:
DE FR GB IT NL

(30) Priority: 31.05.1995 JP 156956/95
20.07.1995 JP 184202/95

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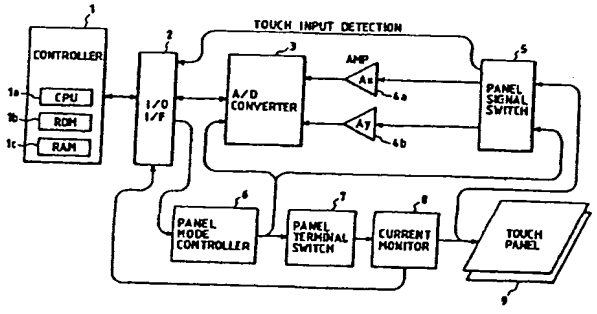
(54) Coordinate detecting device, method therefor and computer control device

(57) In the coordinate detection of resistive film system, detection of the coordinates of simultaneously designated two points is made possible. On a touch panel composed of two conductive films, whether input is made in a point or simultaneously at two points is judged by a current monitor. Simultaneous inputs at two points decrease the apparent resistance of the conductive film, and can be detected by an increase in the current. If the input of a point is identified, the coordinate data of the input point are retained as latest coordinate data in a RAM. If simultaneous inputs at two points are identified, coordinate data are obtained from the coordinate data retained in the RAM and from the potentials in the x and y directions, obtained from two conductive films constituting a touch panel, through amplifiers, and are outputted, together with the coordinate data retained in the RAM, as the coordinate data of the two points.

FIG. 1



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ends thereof and adapted to determine the coordinate of a position entered by pressure on said resistive films from the output potential of the resistive films in response to the input state, comprising a selection area set in a part of the resistive films for selecting the input state; discrimination means for discriminating a one-point input state in which a point is entered by pressure outside the selection area on the resistive films and a two-point simultaneous input state in which, while a first point is entered in the selection area, a second point is entered in succession on the resistive films; storage means for storing the coordinate of the first point; memory means storing a calculation formula for deriving the coordinate of the second point, based on the coordinate positions of the first and second points at the entry of the second point, the output potential of the resistive films at the entry of the second point and the coordinate stored in the storage means; and control means for determining the coordinate of the second point from the output potential of the resistive films based on the calculation formula, when the two-point simultaneous input state is identified by the discrimination means.

According to another aspect of the invention, there is provided a coordinate input device wherein the control means is adapted, in case the two-point simultaneous input state is identified by the discrimination means, to effect an inversion control on the direction of the voltages applied to the resistive films according to the coordinate stored in the storage means, and then to determine the coordinate of the second point from the output potential of the resistive films based on the calculation formula.

According to an embodiment of the present invention, there is provided a coordinate detecting device provided with a panel composed of two conductive films, comprising:

discrimination means for discriminating whether two points are simultaneously depressed on the panel;
retaining means adapted, in case the discrimination means identifies the depression of a point on the panel, to the coordinate of the depressed position as latest coordinate data;
obtaining means adapted, in case the discrimination means identifies the simultaneous depression of two points on the panel, to obtain coordinate data based on the coordinate data retained in the retaining means and potentials in the x and y directions obtained from the conductive films; and
output means for releasing the coordinate data retained in the retaining means and the coordinate data obtained by the obtaining means as the coordinate data of the simultaneously depressed two points.

In the above-mentioned configuration, the latest coordinate data, in case a point is entered on the panel composed of two conductive films, is retained by the retaining means. If the simultaneous depressions of two points are discriminated on the panel, the coordinate data are obtained, based on the coordinate data retained in the retaining means and the potentials in the x and y directions respectively obtained from the two conductive films. The coordinate data thus obtained and the coordinate data retained in the retaining means are released as the coordinate data of the simultaneously entered two points.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing the configuration of a coordinate detecting device embodying the present invention;
Fig. 2 is a view showing the potential distribution on a conductive film;
Fig. 3 is a view showing the configuration of a touch panel of the above-mentioned embodiment;
Fig. 4 is an equivalent circuit diagram showing a state of depression of an arbitrary position on the touch panel;
Fig. 5 which is comprised of Figs. 5A and 5B, is a flow chart showing the sequence of a coordinate detecting process in the above-mentioned embodiment;
Fig. 6 is a flow chart showing the sequence of a coordinate obtaining process in a two-point input mode;
Fig. 7 is a view showing iso-potential lines on the film at the input of two points;
Figs. 8A and 8B are charts showing the potential output of actual films;
Figs. 9A and 9B are charts showing the potential outputs of the x-axis and y-axis films in case the coordinate data (x1, y1) of a first point are (0.1, 0.1) (with coordinates in normalized values);
Figs. 10A and 10B are charts showing the potential outputs of the x-axis and y-axis films in case the coordinate data (x1, y1) of a first point are (0.9, 0.9);
Fig. 11 is a flow chart showing the coordinate calculating process in a two-point input mode in a second embodiment;
Fig. 12 is a block diagram showing the configuration of a coordinate detecting device in a third embodiment;
Figs. 13A and 13B are views showing the configuration of a control program in the above-mentioned embodiment;
Fig. 14 is a schematic block diagram of a fourth embodiment;
Fig. 15 is a schematic view of a touch panel 8;
Fig. 16 is a flow chart showing the function of the fourth embodiment;
Fig. 17 is a flow chart showing the function in a two-point input coordinate calculation mode; and
Fig. 18 is a schematic block diagram of a sixth embodiment.

ing apparatus, such as a host computer, to which the coordinate input device is connected. In the latter case, the coordinate detection of the present embodiment may be realized by supplying the information processing apparatus with the control programs, for realizing the control of the following flow charts, from a memory medium such as a floppy disk or a hard disk.

Fig. 2 shows the potential distribution on a conductive film, wherein iso-potential lines are aligned with equal distances on the film, as shown in Fig. 2. When a point is depressed for example with a finger, the output potential varies according to the position in the vertical direction in Fig. 2. Thus, a same output potential is obtained for a same horizontal position.

In the following there will be explained the operation of obtaining the coordinate in the one-point input mode and in the two-point input mode.

Fig. 3 is a schematic view of the configuration of the touch panel in the present embodiment, and Fig. 4 is an equivalent circuit diagram when an arbitrary position is depressed on the touch panel.

Each of the two conductive films constituting the touch panel 9 has a uniform distribution of the resistance, and Fig. 3 shows a state of applying a voltage in the transversal direction of the panel and obtaining the output from the opposed film (lower film) for voltage application in the vertical direction. In case only one point B is depressed, the output voltage Ex is represented by:

$$x1 = (Ex/E_0) \times Lx_0 \qquad (1)$$

wherein Lx_0 is the lateral length of the panel, E_0 is the applied voltage, and x1 is the distance between the depressed position and the reference plane (shortest distance to the ground electrode). In case one-point input, the lateral position or x-coordinate can be directly detected from the equation (1). The y-coordinate can be detected similarly, by switching the voltage application to the panel through the panel terminal switch 7, so as to apply a voltage to the lower film and obtaining the output potential from the upper film. The coordinate values can thus be obtained by effecting the voltage application to the films in succession and detecting the output potential in succession from the other film. The voltage applied to the panel may be an AC or a DC voltage, and the detection may also be made with the current division ratio, instead of the potential.

In case of two-point inputs, with simultaneous depressions at points A and B as shown in Fig. 4, the current therebetween flows in two paths along the upper and lower films. If the contact resistance between the two films at the contact points becomes negligibly small by the sufficient depressing pressure, the resistance between the points A and B becomes about half, in comparison with the resistance in the undepressed state. Consequently the current on the films increases by the depression of the second point. For example, if the points A and B are respectively positioned at the left- and right-hand ends in Fig. 4, the current is approximately doubled. Thus the inputs at two separate points can be identified from the increase in current, by monitoring the current in the film. Stated differently, the simultaneous inputs at two points can be detected by detecting an increase in the current, resulting from two-point contacts, in the x or y film.

In the following there will be explained, with reference flow charts in Figs. 5A to 6, the sequence of coordinate calculation by the control circuit 1. The flow charts in Figs. 5A and 5B show the sequence of coordinate detection in the present embodiment, while that in Fig. 6 shows the sequence of coordinate obtaining in the two-point input mode.

At first, in the touch input discrimination mode, the panel terminal switch 7 is so switched as to discriminate the presence or absence of a tough input (steps S11, S12). If the touch input is identified as present, there is discriminated whether inputs at two points have been made (step S13). In this operation, the resistances of the two films of the touch panel are respectively detected by the output of the current monitor 8, and the inputs (contacts) at two points are identified if the resistance is lowered.

If the discrimination in the step S13 identifies an input at a point, the sequence proceeds from a step S14 to a step S15 for detecting the x coordinate. The output potential in the x direction is obtained by switching the panel terminal switch 7, then amplified by the amplifier 4a through the panel signal switch 5 and is subjected to A/D conversion by the A/D converter 3. After the A/D conversion, the sequence proceeds from a step S16 to a step S17 wherein the control circuit 1 receives the output potential for the x coordinate in the form of digital data. The control circuit 1 calculates the x coordinate, based on thus received data. The y coordinate is processed in a similar manner as the x coordinate (steps S18 - S20).

Then a step S21 again discriminates the presence or absence of the touch input, in order to judge whether the touch input has been terminated in the course of execution of the coordinate detection explained above. If the touch input is no longer present (i.e., if the touch input has been terminated in the course of execution), the obtained coordinate data are considered unreliable and discarded (step S24). On the other hand, if the touch input still continues, the sequence proceeds to a step S23 to renew the coordinate data of a point in the RAM 1c and to release thus renewed coordinate data. In this manner a cycle of coordinate sampling flow is completed. The coordinate data of a latest point are always stored in the RAM 1c and are utilized in the two-point input mode to be explained later.

On the other hand, if the step S14 identifies inputs at two points in the two-point input discrimination mode, the sequence proceeds to a step S25 for executing a two-point coordinates calculation process which will be explained with reference to the flow chart in Fig. 6.

coordinate data (x2, y2) determined by the calculation and the coordinate data (x1, y1) used in the calculation.

As explained in the foregoing, the calculation in the two-point input mode is executed by the x-potential (Ex2) and the y-potential (Ey2) at the depression of the second point and the coordinate value (x1, y1) entered at the immediately preceding one-point input.

The foregoing operation will be explained with reference to the flow chart in Fig. 6. When two-point inputs are identified, a step S31 detects the potential of the x-axis film. The detected potential is supplied through the panel signal switch 5 and the amplifier 3a to the A/D converter 3, and is released as the x-potential (Ex2) (steps S32 - S34). Then a step S35 detects the potential of the y-axis film. The detected potential is supplied through the panel signal switch 5 and the amplifier 4b to the A/D converter 3, and is released as the y-potential (Ey2) (steps S36 - S38).

A step S39 reads the coordinate data (x1, y1) of a point stored in the RAM 1c. Then a step S40 executes the calculation according to the equations (4) and (5), utilizing thus obtained x-potential Ex2, y-potential Ey2 and the coordinate data (x1, y1), thereby determining the coordinate of the second point.

Then the sequence proceeds to the step S26 in Fig. 5A. A process of evaluating the validity of the coordinate according to whether the touch input continues and disregarding the coordinate if the touch input no longer continues (steps S26 - S28) is same as in the one-point input mode. If the coordinate data of the two points obtained in the foregoing sequence are effective, they are released in a step S29.

As explained in the foregoing, the present embodiment provides a coordinate input device enabling the inputs of two points, with the same touch panel 9 as in the prior art.

[Embodiment 2]

Figs. 9A and 9B show the output potentials of the x- and y-axis films in case the coordinate data (x1, y1) of the first point are (0.1, 0.1) (in normalized values). These output potentials are not much different from the case where the coordinate data of the first point are (0.5, 0.5) shown in Figs. 8A and 8B, and such limited change in the output potentials gives rise to a lowered resolving power in the calculation of the coordinate data (x2, y2). Such loss in the resolving power is not critical if the virtual keyboard extends over the entire area of the touch panel, but becomes a problem if the touch panel becomes larger and the virtual keyboard is formed in a part thereof.

Also Figs. 10A and 10B show the output potentials of the x- and y-axis films in case the coordinate data (x1, y1) of the first point are (0.9, 0.9). These charts indicate that a sufficient output range, or a high resolving power, can be obtained.

The difference between Figs. 9A, 9B and 10A, 10B is the change of the coordinate data of the first point from (0.1, 0.1) to (0.9, 0.9). It is to be noted, however, that the coordinate value on the charts varies according to the direction of the applied voltage E_0. More specifically, by inverting the direction of E_0, x1 = 0.1 becomes x1 = 0.9. It will therefore be understood that two-point inputs with a high resolving power is made possible by inverting the direction of the applied voltage, according to the coordinate data of the first point.

As explained in the foregoing, it is possible, in the inputs of two points, to improve the resolving power by varying the direction of the applied voltage, based on the coordinate data of the first input point, and such variation in the applied direction can be realized by adding a connection form for switching the direction of the applied voltage to the panel terminal switch 7 and by executing a control sequence as shown in Fig. 11.

Fig. 11 is a flow chart showing the coordinate calculation sequence in the two-point input mode in the second embodiment. Immediately before the step S31, there is executed, as shown in Fig. 11, a process of switching the direction of the applied voltage according to the coordinate data of the first point. A step S41 discriminates whether each of the coordinate data (x1, y1), stored in the RAM 1c exceeds 0.4, and, if not, the sequence proceeds to a step S42 to invert the direction of application of the voltage to the film, by controlling the panel terminal switch 7. The panel terminal switch 7, realizing such control, can be easily formed with an electronic switch, such as of FET. In case the direction of the applied voltage is inverted, the original point of the coordinate obtained in the step S40 (Fig. 6) is varied. Therefore, a process of coordinate conversion is executed after the coordinate calculation (steps S43, S44).

As explained in the foregoing, the second embodiment provides a satisfactory resolving power in the two-point input mode, in any portion of the touch panel, by switching the direction of the applied voltage.

[Embodiment 3]

Fig. 12 is a block diagram of a coordinate input device in a third embodiment. The improvement in the resolving power of the output potential may be realized, instead of the switching of the direction of the applied voltage in the foregoing second embodiment, also by optimizing the detection range.

More specifically, an output as shown in Figs. 9A and 9B can well be anticipated from the coordinate data of the first point stored in the memory. In such case, the resolving power of the detection can be maximized by matching such output range with the input range of the A/D converter 3. For this purpose, as shown in Fig. 12, there are provided slice circuits 10a, 10b for eliminating the DC component below the minimum output level, and variable-gain amplifiers 11a, 11b are given such maximum gains as not to saturate at the maximum output level, for processing the outputs of the touch panel 9.

is generated when a depressing operation takes place on the touch panel 8.

The memory 9 stores calculation formulas for calculating the coordinate of the second point, in a two-point mode to be explained later.

The control circuit 1 has two input modes for the coordinate calculation, i.e., a one-point input mode for the entry of a point only, and a two-point input mode for the simultaneous entry of two points.

Also the control circuit 1 arbitrarily defines an area, required for the selection of the two modes, on the touch panel 8, and shifts to the two-point input mode only in case a coordinate input is made in a predetermined area in the one-point input mode and executes the calculation in the two-point input mode until the absence of the touch input is identified next time.

Furthermore, the control circuit 1 is provided therein with a one-point coordinate memory serving as storage means, and the data retained in this one-point coordinate memory are not renewed at the two-point inputs but only in case of the one-point input.

Furthermore the control circuit 1 is provided with a touch input discrimination mode, for discriminating the presence or absence of the touch on the touch panel 8, and is adapted to control the panel mode controller 6 through the I/O interface 2 to control various units and to execute the coordinate detecting procedure in response to a touch input.

The coordinate detecting procedure is executed by the switching of the panel terminal switch 7 by the control circuit 1 through the panel mode controller 6, whereupon the output potential of the touch panel 8 is selected by the panel signal switch 5, then amplified by the amplifiers 4 and converted into digital data by the A/D converter 3. The above-mentioned coordinate detecting procedure is executed for each of x-axis and y-axis.

The converted digital data, obtained in this coordinate detecting procedure, are used for the coordinate calculation in the control circuit 1, according to different calculation formulas depending on the aforementioned one-point input mode or two-point input mode, as will be explained later with reference to flow charts.

Now the method of obtaining the output will be explained with reference to Figs. 4 and 7.

Referring to Fig. 4, if only one point B is depressed, the output potential Ex is given by:

$$x1 = (Ex/E_0) \times Lx_0 \qquad (1)$$

wherein Lx_0 is the lateral length of the panel, E_0 is the applied voltage, and x1 is the distance between the depressed position and the reference plane (i.e., shortest distance to the ground electrode 21a). In case of the one-point input, the lateral position or the x-coordinate can thus be directly detected from the equation (1). The y-coordinate can be detected in a similar manner, by switching the voltage applied to the panel in such a manner that the voltage is applied to the y-axis film 20b and the output potential is taken out from the x-axis film 20a. The voltage applied to the panel may be an AC or DC voltage, and the detection may also be made with the current division ratio, instead of the potential.

In the two-point input mode, the coordinate data of an immediately previously entered point are used because the coordinate input device of the present embodiment is anticipated to be used as a virtual keyboard. In the use as such keyboard, the operations of depressing two points (two keys) cannot take place strictly simultaneously. In such operation, it is customary to at first depress the "shift" key and to depress an alphabet key while the "shift" key is kept depressed, or to at first depress the "ctrl" key and then to depress another key while the "ctrl" key is kept depressed, and, also in consideration of the normal finger operation, it is natural to at first keep a key depressed and to depress another key. Consequently, in the detection of inputs at two points, an input point remains fixed and the other input point is detected as unknown input data. Stated differently, the present embodiment utilizes a fact that two points are not entered at the strictly same time.

Also even after shifting to the two-point coordinate calculation mode, the obtained output potential remains unchanged if the second point is not entered. In such case, there may be selected either to release two same coordinates or only one coordinate, according to the conditions of use.

In the following there will be explained the change in the output potential at the entry of the second point, in the configuration shown in Fig. 15. In case of two-point inputs, with simultaneous depressions at points A and B as shown in Fig. 4, the current therebetween flows in two paths along the upper and lower conductive films 20. If the contact resistance between the two films at the contact points becomes negligibly small by the sufficient depressing pressure, the resistance between the points A and B becomes about half, in comparison with the resistance in the undepressed state.

Fig. 7 shows the iso-potential lines on the film surface at the two-point inputs. In such state, as shown in Fig. 7, the iso-potential lines are no longer parallel straight lines. Between the two contact points, the iso-potential lines are spaced wider, as the resistance between the two points is lowered. As the resistance between the points A and B is approximately halved, the potential Ea at the point A is given by:

$$Ea = (\Delta x/2 + x1)/(Lx_0 - \Delta x/2) \times E_0 \qquad (2)$$

Similarly the potential Eb at the point B is given by:

$$Eb = x1/(Lx_0 - \Delta x/2) \times E_0 \qquad (3)$$

Thus the output potentials of the x-axis film 20a and the y-axis film 20b are not proportional to the respective coordinates.

In the following there will be explained the method of calculating the coordinate of the second point from

At first, when the potential of the x-axis film is detected (S15), the A/D converter 3 starts the A/D conversion (S16).

Then there is discriminated whether the A/D conversion has been completed (S17), and, if not, the A/D conversion is continued, but, if completed, the converted data are supplied to the control circuit 1 through the I/O interface 2 (S18).

When the output of the x-coordinate is completed, the potential of the y-axis film is detected (S19), and the A/D conversion for calculating the y-coordinate is started (S20). Then there is discriminated whether the A/D conversion has been completed (S21), and, if not, the A/D conversion is continued, but, if completed, the converted data are supplied to the control circuit 1 through the I/O interface 2 (S22). Subsequently the immediately previously sampled coordinate data of a one-point input are loaded from the one-point coordinate memory (S23). The control circuit 1 calculates the coordinate of the second point, utilizing the above-mentioned data as one of the data used in the two-point inputs (S24). When the calculation is completed, the presence of the touch input is discriminated as in the one-point input mode (S25), and, in the presence of a touch input, the sequence of Fig. 17 is repeated until the touch input is terminated.

On the other hand, if the touch input is no longer present (if the touch input has been terminated in the course of execution), the obtained data are considered unreliable and discarded (S27). Thus the sub routine of the two-point coordinate calculation is terminated.

As explained in the foregoing, the present embodiment provides a coordinate input device enabling entry of two points with a simple configuration and with a touch panel same as in the prior art, as the coordinate data (x and y coordinates) of the second point in the two-point inputs can be determined by calculation based on the output potential data of the two conductive films 20.

As the coordinate input device of the present embodiment enables input of two points with a simple configuration, particularly without any change in the touch panel, there can be realized a virtual keyboard enabling the input operations same as those in the ordinary keyboard, when the present device is applied to an information processing apparatus utilizing a virtual keyboard.

[Embodiment 5]

In the following there will be explained a fifth embodiment of the present invention, which is identical with the foregoing fourth embodiment except for the panel terminal switch 7 and the control circuit 1.

The panel terminal switch 7 is so constructed, easily with an electronic switch such as of FET, that the switching operation varies according to the value in the one-point coordinate memory.

The control circuit 1 is so constructed as to effect a coordinate conversion process after the coordinate calculation process, since the original point of the coordinate, obtained in the calculation, varies by the switching operation of the panel terminal switch 7.

In the following there will be explained the manner of switching of the panel terminal switch 7 according to the value in the one-point coordinate memory.

Figs. 9A and 9B show the output potential in case the coordinate data (x1, y1) are (0.1, 0.1) (in normalized values), respectively in the x- and y-directions.

These output potentials are not much different from the case shown in Figs. 8A and 8B, and such limited change in the output potentials gives rise to a lowered resolving power in the calculation of the coordinate data (x2, y2). Such loss in the resolving power is not critical if the virtual keyboard extends over the entire area of the touch panel, but becomes a problem if the touch panel becomes larger and the virtual keyboard is formed in a part thereof.

Also Figs. 10A and 10B show the output potentials of the x- and y-axis films in case the coordinate data (x1, y1) are (0.9, 0.9), respectively in the x- and y-directions. These charts indicates that a larger output range, or a higher resolving power, can be obtained in comparison with the case (x1, y1) = (0.1, 0.1).

It is to be noted, however, that the coordinate value on the chart varies according to the direction of the applied voltage E_0. More specifically, by inverting the direction of E_0, x1 = 0.1 becomes x1 = 0.9. Therefore, if the coordinate (x1, y1) has a value deteriorating the resolving power in the calculation of (x2, y2), such as (x1, y1) = (0.1, 0.1), the panel terminal switch 7 can be shifted to obtain a sufficient output range.

Thus the above-explained configuration enables two-point inputs with a sufficient resolving power, by shifting the panel terminal switch 7 to invert the direction of the applied voltage according to the value of the one-point coordinate memory.

[Embodiment 6]

In the following there will be explained a sixth embodiment of the present invention, of which block diagram is shown in Fig. 18.

The device of the present embodiment is provided, in addition to the configuration of the foregoing fourth embodiment, with slicing circuits 10a, 10b for eliminating a DC component not reaching the minimum output level of the touch panel 8, and variable-gain amplifiers 11a, 11b instead of the amplifiers 4a, 4b.

The device of the present embodiment employs, for improving the resolving power of the output potential, a method of optimizing the detection range, instead of the method of inverting the applied voltage in the foregoing fifth embodiment.

An output range as shown in Fig. 16 can be anticipated from the value of the one-point coordinate memory. Consequently the employed method utilizes a fact

5. A coordinate detecting device according to claim 4, wherein said varying means includes slicing means for eliminating an unnecessary output potential level based on the ranges of the potentials in the x and y directions, obtained from said conductive films.

6. A coordinate detecting method utilizing a panel composed of two conductive films, comprising:

a discrimination step for discriminating whether two points are simultaneously depressed on said panel;
a retaining means adapted, in case said discrimination step identifies that a point is depressed on said panel, to retain the coordinate of said depressed position as latest coordinate data;
an obtaining step adapted, in case said discrimination step identifies that two points are simultaneously depressed on said panel, to obtain coordinate data based on the coordinate data retained by said retaining step and potentials in the x and y directions obtained from said conductive films; and
an output step for outputting the coordinate data retained by said retaining step and the coordinate data obtained by said obtaining step as the coordinate data of the simultaneously depressed two points.

7. A coordinate detecting method according to claim 6, wherein said discrimination step is adapted to discriminate whether two points are simultaneously depressed on said panel, based on a decrease in the resistance of at least either of said two conductive films.

8. A coordinate detecting device according to claim 6, wherein said obtaining step includes:

a switch step for switching the direction of application of a voltage to said conductive films, based on the coordinate data retained in said retaining step;
a calculation step for calculating the coordinate data based on the coordinate data retained in said retaining step and the potentials in the x and y directions obtained from said conductive films; and
a conversion step for converting the coordinate data, calculated by said calculation step, based on the direction of application of the voltage controlled by said switch step.

9. A coordinate detecting method according to claim 6, further comprising:

a varying step adapted, in case said discrimination means identifies that two points are simultaneously depressed on said panel, to vary an amplification range for the potentials in the x and y directions, obtained from said conductive films.

10. A coordinate detecting device according to claim 9, wherein said varying step includes a slicing step for eliminating an unnecessary output potential level based on the ranges of the potentials in the x directions, obtained from said conductive films.

11. A computer controlling device for controlling a computer by reading a predetermined program from a memory medium, wherein said memory medium includes:

a process code of a discrimination step for discriminating whether two points are simultaneously depressed on a panel composed of two conductive films;
a process code of a retaining step adapted, in case said discrimination step identifies that a point is depressed on said panel, to retain the coordinate of said depressed position as latest coordinate data;
a process code of an obtaining step adapted, in case said discrimination step identifies that two points are simultaneously depressed on said panel, to obtain coordinate data based on the coordinate data retained by said retaining step and potentials in the x and y directions obtained from said conductive films; and
a process code of an output step for outputting the coordinate data retained by said retaining step and the coordinate data obtained by said obtaining step as the coordinate data of the simultaneously depressed two points.

FIG. 2

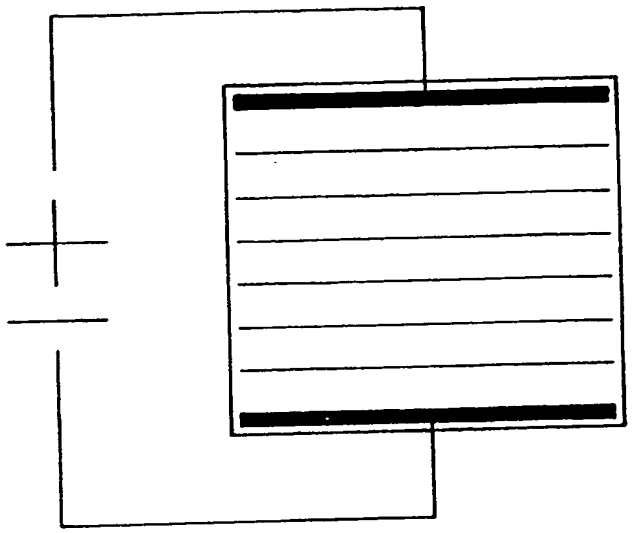

FIG. 3